

# **Tennyson Street, N.W. Traffic Calming Study**

*Prepared for:*

**District Department of Transportation  
Transportation Policy and Planning Administration**

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# Tennyson Street, NW

## I. Introduction

The study area for the Tennyson Street, N.W., Traffic Calming Study is between Western Avenue and Utah Avenue. There are 47 households along this corridor, with parking allowed on both sides of the street. The width of the entire corridor of Tennyson Street, NW within the study area is 30 feet. This portion of Tennyson Street is designated a local street<sup>1</sup> in a residential area, and the existing major traffic problems primarily are a result of ‘cut-through’ traffic. In November 2002, the owners of twelve out of the thirteen within the 3200 block of Tennyson Street, N.W., signed a petition to support traffic calming measures installed along this corridor. Specifically, residents requested the installation of a speed hump, as defined by the 2002 *District of Columbia Department of Transportation’s Traffic Calming Policies and Guidelines*.

According to the DDOT guidelines and the Institute of Transportation Engineers (ITE), traffic calming involves changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and/or cut-through volumes, in the interest of street safety, livability, and other public purposes.

Although the original petition was for the section of Tennyson Street from 33<sup>rd</sup> Street to Utah Avenue, in an effort to provide residents of the community with a comprehensive traffic calming strategy, DDOT extended the boundaries of this study to include Tennyson from Western Avenue to Utah Avenue. From the outset of this process DDOT has remained aware that reducing speeds and/or traffic volumes on the study portion of Tennyson Street might cause an increase in traffic volumes and speeds on adjacent streets, therefore this study analyzes the entire network of streets around Tennyson Street, NW. The north and south boundaries for this study are Worthington Street and Rittenhouse Street, N.W. Advisory Neighborhood Commission (ANC) 3/4G held a community meeting on April 14, 2003 to solicit the community concerns regarding this project, thereafter DDOT began the Tennyson Street Traffic Calming Study.

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<sup>1</sup> The roadways in Washington DC are classified in the following categories: interstate, other freeways & expressways, principles, minors, collectors, and local streets.

## II. Study Findings

### 1. *Study Area Description*

Western Avenue, the west boundary of the study area, is the jurisdictional boundary between Washington, DC and Maryland. As shown by Figure 1, two collector streets, Western Avenue and Utah Avenue as mentioned before, also serve as west and east boundary of the study area, and one local street, 33<sup>rd</sup> Street, from Pinehurst Circle is the north boundary for this study. Tennyson Street and Rittenhouse Street are two residential streets that provide direct linkage from Western Avenue to Utah Avenue, therefore some drivers use these local streets as ‘cut-throughs’ to travel between the two collector streets of Western and Utah. Thirty third Street also intersects with the study portion of Tennyson Street, carrying some of the traffic traveling from collectors to residential streets. Chevy Chase Circle is on Western Avenue southwest of the study area and is a heavily used interchange for roadways. Pinehurst Circle and Chevy Chase Circle can be deemed as two major traffic radiators/absorbers in this area. The Board of Zoning classifies the study area as R-1B Residential.

### 2. *Traffic Conditions*

The speed limit on all the local streets in this area is 25 mph. Parking is allowed on both sides of Tennyson Street, with about 50% of the parking spaces used during the daytime. Little or no bicycle traffic was observed on Tennyson and pedestrian traffic is also light. The 3200 and 3300 blocks of Tennyson Street, N.W. are not snow routes, bus routes, or emergency routes for fire, police stations, or hospitals. There are no schools along this corridor study area and trucks over 1¼ tons are not allowed to use the study street.

### 3. *Tennyson Street Level Of Service (LOS)*

Based on the traffic volume information collected during peak hours for intersections of Tennyson Street with Western Avenue and Utah Avenue, traffic was simulated using Synchro 5.0 to estimate the Level of Service (LOS) for these two intersections. The results of the simulation indicate that both of these intersections are at LOS A (see Table 1a and 1b), which is very good.

### 4. *Geometric and Roadway Conditions*

The Tennyson study corridor has a 1.2% degree grade with the west side higher in altitude, while the roadway surface is of relatively poor condition with several potholes. The roadway is well aligned; with no double yellow line in the middle and the width of Tennyson Street is 30 feet, from curb to curb. There are 38 trees, 47 households, and 22 driveways existing on the study portion of Tennyson Street.

## *5. Traffic Accident Reported*

According to the traffic accident database stored in the Traffic Accident Reporting and Analysis System (TARAS) of DDOT, there was only one traffic accident in the study area between 1997 – 2002. Table 2 provides detailed information about this accident. This lone accident took place on May 9, 2000, in front of 3319 Tennyson Street, N.W. between a truck and a parked passenger car. At the time of the accident, the car was parked along Tennyson Street, and the truck was turning right on Tennyson Street from Western Avenue. The driver of the truck hit the parked car but did not wait at the scene to provide the Metropolitan Police with any information.

## *6. Traffic speed and volume*

According to the speed study DDOT performed for this study, the measured speed of vehicles traveling along Tennyson Street ranged from a low of 15 mph to a high of 40 mph (Table 3). Further, the vehicles on Western Avenue (a collector street) tend to travel faster than those on Tennyson Street (a local street), indicating that it is difficult for vehicles to make safe turns between Tennyson Street and Western Avenue. Tables 4 a, b and c show DDOT's observed traffic volume data. During peak hours, the hourly traffic volume on Tennyson Street ranges from 158 to 203 cars in both directions.

## *7. Analysis of the traffic problems*

### **a. Cut-Through Traffic**

During morning peak hours, some motorists cut through Tennyson Street to avoid heavy traffic on collector streets such as Western Avenue. During afternoon peak hours, some of the people going home also cut-through Tennyson Street. (See Table 4a for cut-through traffic volumes.)

### **b. Speed of Traffic on Nearby Collector Streets**

Although speed limits on collectors Utah Avenue and Western Avenue are both 25 mph, a lot of the traffic, especially that on Western Avenue, travel well beyond the posted speed limit. From Table 3 we can see that the highest and lowest recorded speeds on Western Avenue are 43 mph and 21 mph, respectively. DDOT analysis indicates that Western Avenue traffic enters Tennyson Street the vehicles tend to retain their high speeds. Slowing down this speed is one of the major goals of this traffic calming study. However, increased Metropolitan Police Department (MPD) speed enforcement is the best solution for speed enforcement on collectors and arterials within the District of Columbia.

**c. Intersection of Tennyson Street and Western Avenue**

The intersection of Tennyson and Western Avenue forms a sharp angle of about 45 degrees (Figure 1). Due to the speed of traffic on Western Avenue it is very difficult for vehicles on Tennyson Street to turn on Western Avenue, particularly left turns. Slowing down Western Avenue traffic or restricting its ability to use Tennyson Street will alleviate this problem.

**d. Noise**

As a result of the poor condition of the pavement surface on Tennyson Street, vehicles produce considerable noise. The noise influences everyday quality of life for the residents.

### **III. Recommendations**

The major traffic problems within the study area are traffic volume, speed, and noise. Many traffic calming measures are already in use in the United States and have been effective in slowing down traffic. Among these initiatives, several are appropriate for remedying the problems on Tennyson Street.

The recommended traffic calming measures for Tennyson Street include **speed humps, speed hump warning signs and markings, speed limit signs, and turn restriction signs**. According to data from *Traffic Calming – State of the Practice* of Institute of Transportation Engineers, speed humps are effective in reducing both traffic speed and volume by up to 20% in the immediate area of the hump. Also, installing speed limit signs is useful to reduce speeds and aid enforcement. Turn restriction is valid in reducing the traffic volume. (Tables 5a, b, and c.)

Specifically, DDOT recommends the installation of the following devices to reduce the traffic for the study area:

**a. Speed humps**

Install two 12' wide 4" high-speed humps, one in the middle of each block of 3200 and 3300 blocks of Tennyson Street, N.W. These humps would effectively reduce the traffic speed and discourage cut-through traffic.

**b. Speed hump warming signs**

Two "HUMP AHEAD" signs need to be installed for each hump, one for each direction. Each of the two markings on a hump points to the respective direction of travel and also highlights the speed humps.

**c. Speed limit signs**

Install two "**Speed Limit 25 mph**" signs along Western Avenue close to the intersection with Tennyson Street, with one north of the intersection, the other south of the intersection. Install two "**Speed Limit 25 mph**" signs along Utah Avenue close to the intersection with Tennyson Street, with one north of the intersection, the

other south . These signs would alert motorists to the legal speed on Western Avenue and Utah Avenue. Furthermore, establish police enforcement to ensure that motorists obey these regulations.

**d. No turn restriction signs**

Install a **NO RIGHT TURN (7:00-9:30 AM, Monday-Friday)** sign on Western Avenue at Tennyson Street for northbound traffic, and a **NO LEFT TURN (7:00-9:30 AM, Monday-Friday)** sign on Western Avenue at Tennyson Street for southbound traffic, to block the cut through traffic from Western Avenue and Utah Avenue during morning rush hours. Based upon DDOT analysis, there is usually more outbound right turning movements than inbound left turning movements during morning rush hours, thus it is proposed that both turning movements be restricted.

Install a **NO LEFT TURN (4-6:30 PM Monday-Friday)** sign on Utah Avenue at Tennyson Street for the northbound traffic, to block the cut through traffic from Utah Avenue to Western Avenue during afternoon rush hours.

Residents of Tennyson Street can gain access during these time periods utilizing 33<sup>rd</sup> Street.

**e. Roadway repaving**

Repave the roadway surface to improve the traffic conditions and reduce the noise level.

**f. Striping edge lines around parking areas**

Stripe a white-solid-marking line eight feet from the curve line of Tennyson Street at the edges of parking areas. The striping will give the drivers the impression that the street is narrower thus helping to slow down motorists.

After installing the proposed traffic calming measures mentioned above, the traffic speed and volume on Tennyson Street should be reduced. Due to the direct links between Tennyson and Rittenhouse Streets to Western and Utah Avenues all of these streets were analyzed comprehensively. DDOT anticipates the recommended traffic calming measures will keep most traffic on Western and Utah Avenues because there are no other convenient east-west street is available for commuter traffic. This study encourages 'cut through' traffic to remain on Western Avenue or Utah Avenue.

## IV. Cost estimate

The estimated total cost for the proposed traffic calming measures is about **\$111,401** (including repaving). Please refer to Table 6 for details.

Items	Quantities	Unit	Unit Price	Sub Total
12-foot Speed Humps	2	EACH	\$2,500 <sup>2</sup>	\$5,000.00
HUMPS AHEAD Signs	2	EACH	\$86.62	\$173.24
Markings on hump	4	EACH	\$77.08	\$308.32
NO RIGHT TURN Sign 7:00-9:30 am	1	EACH	\$86.62	\$86.62
NO LEFT TURN Sign 4:00-6:30 pm	2	EACH	\$86.62	\$86.62
Speed Limit Signs	4	EACH	\$86.62	\$346.48
Repaving Roadway	1700 feet pavement	N/A	N/A	\$102,000.00 <sup>3</sup>
Striping edge lines around parking areas	3400 feet	EACH FOOT	\$1.00	\$ 3,400.00
<b>Total Cost</b>				<b>\$111,401.28</b>

*Table 6. Quantities and cost estimates for traffic calming measures*

## V. References

1. DDOT, *District of Columbia Traffic Calming Policies and Guidelines*, 2002
2. Ewing, Reid H., ITE and FHWA, US DOT, *Traffic Calming – State of the Practice*, 1999
3. Municipality of Anchorage Traffic Department, *Traffic Calming Protocol Manual*, March 2001

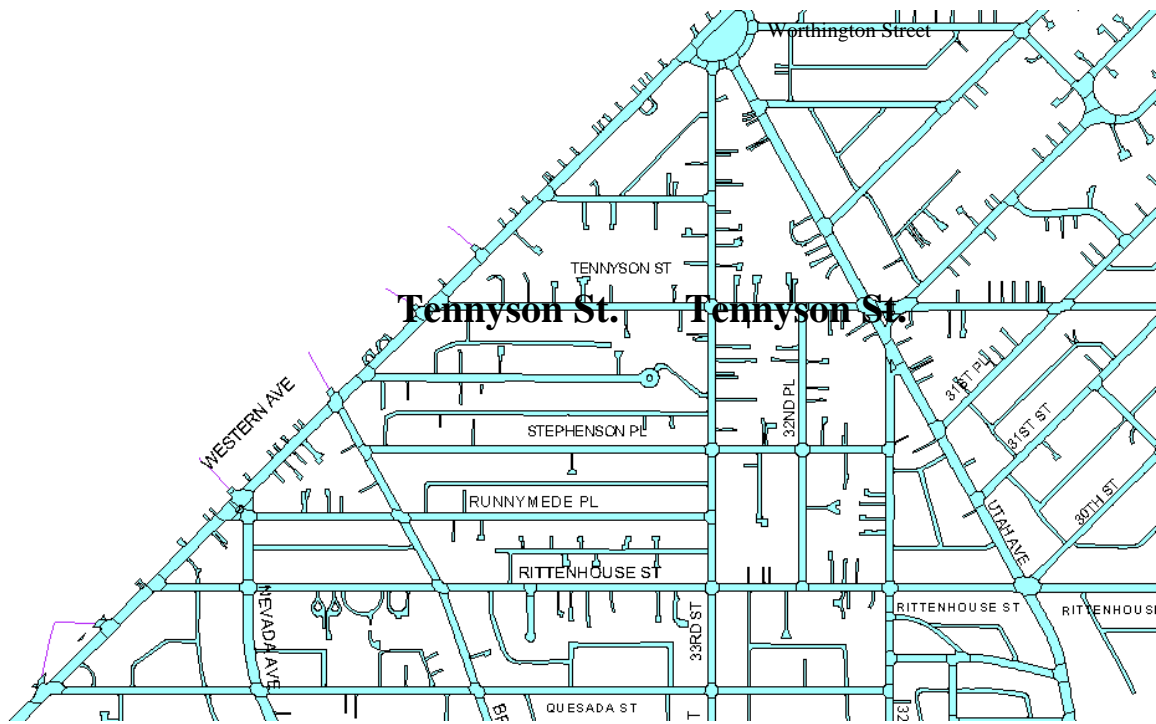
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<sup>2</sup> Based on DDOT 1999 estimates.











<sup>3</sup> Please see the appendices.



















## VI. Figures and Tables



***Figure 1. Study Area for Traffic Calming Project, Task No. 3: 3200 & 3300 Blocks of Tennyson Street, NW, Western Avenue to Utah Avenue, Runnymede Place to Worthington Street***

						
Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Turning Speed (mph)	15	9		9	15	
Lane Util. Factor	1.00	1.00	0.95	0.95	0.95	0.95
Frt		0.850	0.967			
Flt Protected	0.950					
Satd. Flow (prot)	1770	1583	3422	0	0	3539
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1583	3422	0	0	3539
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	30		30			30
Link Distance (ft)	2417		414			561
Travel Time (s)	54.9		9.4			12.8
Volume (vph)	28	4	140	40	0	308
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	4	152	43	0	335
Lane Group Flow (vph)	30	4	195	0	0	335
Sign Control	Stop		Free			Free
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	19.3%			ICU Level of Service A		

*a. Intersection of Tennyson Street and Western Avenue*

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Frt		0.925			0.923			0.976				
Flt Protected					0.995			0.992			0.985	
Satd. Flow (prot)	0	3274	0	0	3250	0	0	3427	0	0	3486	0
Flt Permitted					0.995			0.992			0.985	
Satd. Flow (perm)	0	3274	0	0	3250	0	0	3427	0	0	3486	0
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1399			476			517			579	
Travel Time (s)		31.8			10.8			11.8			13.2	
Volume (vph)	0	32	32	4	16	20	8	36	8	4	8	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	35	35	4	17	22	9	39	9	4	9	0
Lane Group Flow (vph)	0	70	0	0	43	0	0	57	0	0	13	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	13.3%			ICU Level of Service A								

*b. Intersection of Tennyson Street and Utah Avenue*

***Table 1. Report from Synchro 5 simulation***

Date of Accident	09-May-00
Time	21:00
Day of the week	Saturday
Type Of Accident1	Property Damage, Hit and Run
Accident Occurred on	TENNYSON ST
Address Block	3319
Quadrant	NW
District	2
Number of vehicles involved	2
Number of injured persons	0
Enter feet from object	0
Enter direction from object	S
Enter object name	WESTERN AVE
Intersection Name	TENNYSON ST AND WESTERN AVE
On street	Not at Intersection
Type of Collision	Parked Vehicle
Road Surface	Asphalt
Road Condition	Dry
Weather	Clear
Pedestrian Clothing	N/A
Vehicle1 Type	Truck/Trailer
Vehicle2 Type	Passenger Auto
Cost (dollars)	6400
Injury Or Fatality	0

***Table 2. Reported traffic accident on Tennyson Street during the years 1997-2002***

Location		Date	Day	Time	Lowest Speed	Highest Speed	Average Speed	85th Percentile Speed	Vehicles Observed
Tennyson St, 600' East of Western Ave, NW	Eastbound	5/20/2003	Tuesday	7- 8 am	17	37	24	27	51
	Westbound	5/20/2003	Tuesday	7- 8 am	17	35	27	30	96
	Eastbound	5/20/2003	Tuesday	10 -11am	15	32	23	28	46
	Westbound	5/20/2003	Tuesday	10 -11am	16	35	24	29	58
	Eastbound	5/20/2003	Tuesday	4 - 5 pm	16	33	24	29	58
	Westbound	5/20/2003	Tuesday	4 - 5 pm	17	40	25	29	47
Western Ave, 150' South of of Tennyson St, NW	Northbound	5/20/2003	Tuesday	8:15-9:15am	21	39	29	33	100
	Southbound	5/20/2003	Tuesday	8:15-9:15am	23	43	31	34	100
	Northbound	5/20/2003	Tuesday	11:30am-12:30pm	21	39	29	32	100
	Southbound	5/20/2003	Tuesday	11:30am-12:30pm	21	38	29	32	100
	Northbound	5/20/2003	Tuesday	5:15-6:05pm	21	41	30	32	100
	Southbound	5/20/2003	Tuesday	5:15-6:05pm	21	40	31	34	100
Rittenhouse St, 250' West of Utah Ave, NW	Eastbound	5/22/2003	Thursday	7- 8 am	17	31	23	25	67
	Westbound	5/22/2003	Thursday	7- 8 am	15	34	23	27	70
	Eastbound	5/22/2003	Thursday	10 -11am	20	37	25	27	34
	Westbound	5/22/2003	Thursday	10 -11am	17	31	25	27	32
	Eastbound	5/22/2003	Thursday	4 - 5 pm	18	31	24	26	55
	Westbound	5/22/2003	Thursday	4 - 5 pm	15	32	25	28	45

*Table 3. Vehicle speed data collected by speed radars*

	Location: Tennyson St between Western Ave and 33rd St, NW, Eastbound				Location: Tennyson St between Western Ave and 33rd St, NW, Westbound				
Begin Time	Mon	Tue	Wed	Thu	Tue	Wed	Thu	Fri	Mon
	19-May	20-May	21-May	22-May	13-May	14-May	15-May	16-May	19-May
5am	11	6	9	*	104	104	109	98	88
6am	22	28	32	*	135	117	129	98	100
<b>7am</b>	<b>94</b>	<b>108</b>	<b>81</b>	*	<b>80</b>	<b>93</b>	<b>92</b>	<b>80</b>	<b>90</b>
<b>8am</b>	<b>106</b>	<b>103</b>	<b>112</b>	*	<b>83</b>	<b>69</b>	<b>72</b>	<b>44</b>	<b>60</b>
<b>9am</b>	<b>85</b>	<b>96</b>	<b>86</b>	*	<b>74</b>	<b>93</b>	<b>88</b>	<b>73</b>	<b>73</b>
10am	62	74	67	*	88	84	103	91	94
11am	68	65	60	*	87	86	87	80	70
12noon	87	98	76	*	85	83	71	86	93
1pm	67	94	92	*	134	87	97	94	100
2pm	82	81	89	*	109	88	100	82	93
3pm	97	89	96	*	105	110	121	98	138
<b>4pm</b>	<b>86</b>	<b>96</b>	<b>101</b>	*	<b>124</b>	<b>103</b>	<b>108</b>	<b>116</b>	<b>117</b>
<b>5pm</b>	<b>105</b>	<b>114</b>	<b>112</b>	*	<b>88</b>	<b>82</b>	<b>79</b>	<b>90</b>	<b>97</b>
<b>6pm</b>	<b>115</b>	<b>109</b>	<b>116</b>	*	<b>60</b>	<b>71</b>	<b>59</b>	<b>62</b>	<b>58</b>
7pm	102	90	87	*	30	65	47	52	34
8pm	56	60	77	*	32	28	25	63	41
24-hr total	1367	1416	1452		1485	1421	1449	1383	1416

*Table 4a. Observed hourly traffic volume data along Tennyson St  
between Western Ave and 33rd St, NW*

	Location: Western Ave between Tennyson St and Stuyesant Pl, NW, Southbound					Location: Western Ave between Tennyson St and Stuyesant Pl, NW, Northbound				
Begin Time	Tue	Wed	Thu	Fri	Mon	Tue	Wed	Thu	Fri	Mon
	13-May	14-May	15-May	16-May	19-May	13-May	14-May	15-May	16-May	19-May
5am	39	39	46	30	39	8	14	12	16	15
6am	136	139	130	119	117	60	54	54	39	58
<b>7am</b>	<b>424</b>	<b>442</b>	<b>426</b>	<b>403</b>	<b>403</b>	<b>145</b>	<b>155</b>	<b>137</b>	<b>123</b>	<b>133</b>
<b>8am</b>	<b>506</b>	<b>564</b>	<b>489</b>	<b>469</b>	<b>455</b>	<b>233</b>	<b>229</b>	<b>231</b>	<b>200</b>	<b>228</b>
<b>9am</b>	<b>350</b>	<b>340</b>	<b>323</b>	<b>298</b>	<b>341</b>	<b>155</b>	<b>164</b>	<b>172</b>	<b>158</b>	<b>194</b>
10am	227	251	242	236	245	158	174	172	141	163
11am	226	238	266	253	226	204	211	199	209	193
12noon	254	253	267	282	226	228	237	254	248	236
1pm	211	225	243	222	221	198	209	186	217	185
2pm	242	243	254	249	244	208	225	236	256	244
3pm	309	288	289	211	250	368	369	358	329	316
<b>4pm</b>	<b>253</b>	<b>237</b>	<b>263</b>	<b>225</b>	<b>235</b>	<b>396</b>	<b>387</b>	<b>394</b>	<b>380</b>	<b>348</b>
<b>5pm</b>	<b>228</b>	<b>254</b>	<b>228</b>	<b>230</b>	<b>233</b>	<b>412</b>	<b>420</b>	<b>495</b>	<b>427</b>	<b>453</b>
<b>6pm</b>	<b>258</b>	<b>251</b>	<b>294</b>	<b>299</b>	<b>210</b>	<b>408</b>	<b>422</b>	<b>381</b>	<b>406</b>	<b>423</b>
7pm	181	174	182	275	174	232	282	246	251	246
8pm	109	102	92	135	123	183	179	190	172	162
24-hr total	4141	4271	4278	4246	3942	3907	4083	4106	4047	3932

*Table 4b. Observed hourly traffic volume data along Western Ave  
between Tennyson St and Stuyesant Pl, NW*

	Location: Utah Ave between 32nd St and 31st St, NW, Southbound					Location: Utah Ave between 32nd St and 31st St, NW, Northbound			
Begin Time	Tue	Wed	Thu	Fri	Mon	Tue	Wed	Thu	Fri
	13-May	14-May	15-May	16-May	19-May	13-May	14-May	15-May	16-May
5am	3	5	1	5		7	5	8	9
6am	7	4	3	12	6	25	49	42	65
<b>7am</b>	<b>7</b>	<b>14</b>	<b>10</b>	<b>23</b>	<b>5</b>	<b>64</b>	<b>81</b>	<b>78</b>	<b>67</b>
<b>8am</b>	<b>25</b>	<b>20</b>	<b>19</b>	<b>34</b>	<b>17</b>	<b>39</b>	<b>52</b>	<b>55</b>	<b>62</b>
<b>9am</b>	<b>52</b>	<b>43</b>	<b>28</b>	<b>40</b>	<b>19</b>	<b>39</b>	<b>49</b>	<b>33</b>	<b>50</b>
10am	65	35	31	39	43	35	55	37	43
11am	40	36	43	27	29	50	38	55	58
12noon	38	31	45	28	33	42	59	51	56
1pm	50	45	49	47	47	44	63	45	65
2pm	71	41	64	60	50	79	78	79	77
3pm	41	37	36	55	52	86	72	78	72
<b>4pm</b>	<b>39</b>	<b>42</b>	<b>40</b>	<b>57</b>	<b>69</b>	<b>81</b>	<b>85</b>	<b>76</b>	<b>84</b>
<b>5pm</b>	<b>45</b>	<b>55</b>	<b>46</b>	<b>52</b>	<b>50</b>	<b>128</b>	<b>103</b>	<b>101</b>	<b>105</b>
<b>6pm</b>	<b>40</b>	<b>47</b>	<b>42</b>	<b>69</b>	<b>70</b>	<b>111</b>	<b>106</b>	<b>79</b>	<b>53</b>
7pm	46	38	44	37	34	69	52	52	46
8pm	34	24	29	30	28	39	53	42	56
24-hr total	672	585	592	701	690	1022	1083	988	1073

*Table 4c. Observed hourly traffic volume data along Utah Ave  
between 32nd St and 31st St, NW*

Community/Location	Measure	85th Percentile Speed (mph)			Volumes (vehicles/day)		
		Before	After	% Change	Before	After	% Change
Montgomery County, MD							
Notley Rd	12' humps	39	32	-18%	1420	900	-37%
Aberdeen Rd	12' humps	36	27	-25%	1350	760	-44%
Durbin Rd	12' humps	33	25	-24%	810	500	-38%
Shorefield Rd	12' humps	35	29	-17%	1240	1530	23%
Counselman Rd	12' humps	34	31	-9%	970	560	-42%
Westbard Ave	12' humps	35	28	-20%	990	920	-7%
Thayer Ave	12' humps	35	29	-17%	860	780	-9%
Burdette Rd	12' humps	40	34	-15%	1330	1110	-17%
Great Oak Rd	12' humps	37	32	-14%	410	320	-22%
McKnew Rd	12' humps	39	29	-26%	850	1090	28%
Rock Run Dr	12' humps	38	29	-24%	350	290	-17%
Lilly Stone Dr	12' humps	36	29	-19%	1130	700	-38%
Fraley Farm Rd	12' humps	39	30	-23%	730	770	5%
Northwest Dr	12' humps	34	30	-12%	1140	320	-72%
Stapleford Hall Dr	12' humps	39	31	-21%	1090	860	-21%
Cherry Grove Dr	12' humps	38	33	-13%	980	870	-11%
Average % change				-19%			-20%

***a. Effect of speed humps***

Community/Location	Measure	85th Percentile Speed (mph)			Volumes (vehicles/day)		
		Before	After	% Change	Before	After	% Change
Boulder, CO							
9th St (Pine to Mapleton)	Speed limit signs	32	31	-3%	N/A		

***b. Effect of speed limit signs***

		85th Percentile Speed (mph)			Volumes (vehicles/day)		
Community/Location	Measure	Before	After	% Change	Before	After	% Change
Phoenix, AZ							
35th St	Turn restrictions (peak hours only)	N/A			175	60	-66%
Mercer Lane	Turn restrictions (peak hours only)	N/A			178	41	-77%
37th St	Turn restrictions (p.m. peak only)	N/A			171	86	-50%
Grenada Rd	Turn restrictions (p.m. peak only)	N/A			56	27	-52%
Average % change				-12%			-61%

***c. Effect of turn restrictions***

**Table 5. Effect of different traffic calming measures in reducing traffic speed and volume**